KATHOLIEKE UNIVERSITEIT LEUVEN

# Applied Rheology and Polymer Processing

## Self-assembly of sheet-like particles at interfaces

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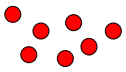
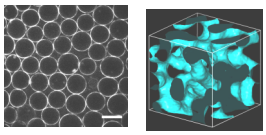
**Abstract**

Particles with tuned properties

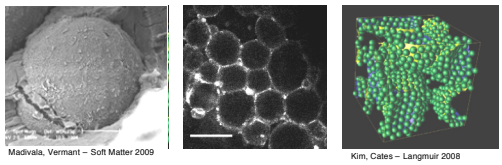


+

Interface between immiscible fluids



Complex microstructures with enhanced properties

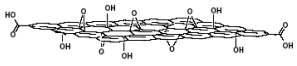


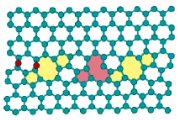
Madivala, Vermant – Soft Matter 2009

Kim, Cates – Langmuir 2008


## GRAPHITE OXIDE (GO) SHEETS:

Single layers of carbon, obtained by strong oxidation of graphite

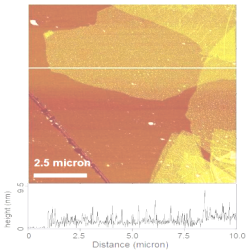




**SHEETS**

Lateral size: ~ 10 µm

Thickness ~ nm




Hirata M. –Carbon 42 (2004)
Stankovich S. – Ruoff R.S. - Carbon 45 (2007)

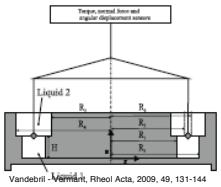
## Why GO?:

- Super-strong material
- Chemical reduction makes GO highly conductive ('*graphene*')
- GO is very versatile by chemical grafting
- Sheet particles: very high surface area

Zhu Y – Ruoff R.S. - Appl. Phys. Lett. 95, 103104 – (2009)
Chen C. – Cheng H.M. - Adv. Mater. (2009), 21, 3007–3011

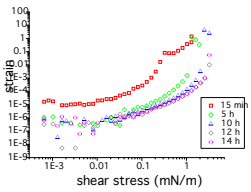
## GO sheets at the oil/water interface

### Shear rheology

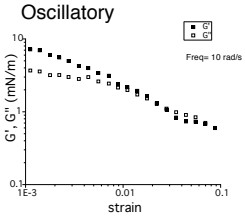


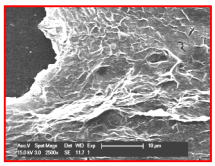

Vandebril - Vermant, Rheol Acta, 2009, 49, 131-144

Flow



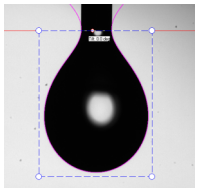

Oscillatory

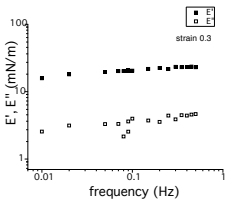


GO layer at oil-water interface

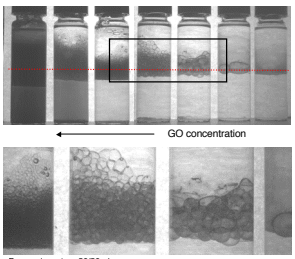
### Dilatational rheology



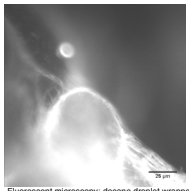



- The interfacial layer is strong and highly elastic both in shear and dilation
- It can mechanically hold a microstructure!

## Using interfaces to make complex structures: Oil in water emulsions




Decane in water - 50/50 v/v



Fluorescent microscopy: decane droplet wrapped in graphite oxide sheets (fluorescent)

- Highly stable (~months)
- Tunable droplet size
- Complex microstructure!

## Conclusions

- GO-laden interfaces are stable and highly elastic
- GO-stabilized emulsions: a way to combine high mechanical properties of interfaces with a complex microstructure
- The system can be tuned in size and mechanical properties
- Possibility of tuning optical properties and conductivity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